REMARKS

I. Introduction

Claims 1-13 were pending in the present application all of which were rejected. Claims 1, 8, and 9 have been amended, claims 2 and 10 have been cancelled, and claims 14-18 have been newly added. Claim 1 has been amended to recite that the film-forming polymer (A) has an acid number of from 25 to 350mg KOH/g and that M is Cu, Zn or Te, and that n is an integer of 1 to 2 when X is a pentavalent phosphorous and n is an integer of 1 for all other groups for X, and the copper-based biocide comprises one or more of cuprous oxide, cuprous thiocyanate, cuprous sulphate and copper pyrithione; wherein the antifouling coating composition comprises less than 1 wt.% of biocidal zinc compounds and less than 1 wt.% of rosin. Further reference to film-forming polymer (B) has been deleted from claim 1. Support for the amendments to claim 1 can be found, *inter alia*, in claim 2 as originally submitted and on page 6. second paragraph, page 9, lines 12-13, page 10, lines 3-6, and page 15, lines 21-27 of the specification. Claim 8 has been amended merely to correct a typographical error. Claim 9 has been amended to recite that the process for protecting a man-made structure to be immersed in a fouling aquatic environment comprises the step of applying the antifouling coating composition according to claim 1 to said structure. Support for the amendments to claim 9 can be found, *inter alia*, on page 18, lines 20-24 of the specification.

Newly added claims 14 and 15 further define metallic copper content in the antifouling composition of claim 1. Support for newly added claims 14 and 15 can be found, inter alia, on page 9, lines 21-25. Newly added claim 16 is directed to an anti-fouling composition defining R as an organic residue OC(=O)R`, support for which can be found, *inter alia*, in claims 1, 3, and 4 as originally submitted and on page 7, lines 1-3 of the specification. Claims 17 and 18 further define the anti-fouling compositions of claims 1 and 16 respectively, further comprising polymer (B) in an amount of 80-0% by weight calculated on the total amount of film-forming components. Support for claims 17 and 18 can be found, *inter alia*, in claim 1 as originally presented and on page 11, lines 25-27 and page 15, line 22 to page 16, line 9 of the specification.

The specification has been amended by replacing the abstract with an amended less lengthy abstract. For at least the following reasons, Applicants respectfully submit that the pending claims are patentable, and request that the aforementioned rejections be withdrawn.

II. Objections to the Specification

The abstract of the disclosure is objected to because according to the Examiner its length is undue and exceeds the limit of 150 words or less. In response applicants have amended the abstract of the disclosure to reduce its length while defining the field of the invention without adding new matter. Therefore, applicants submit that the abstract of the disclosure, as amended, is no longer undue and does not exceed the limit of 150 words or less. Withdrawal of the objection is respectfully requested.

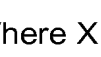
III. Objections to the Claims

Claims 1 and 8 were objected to because according to the Examiner claim 1 included a period before the end of the claim and included an extra word in the phrase in line 9 of "alkali metals metal." In response applicants have removed the additional period prior to the ending of the claim. The section of the claim which contained the phrase "alkali metals metal" has been removed making this objection moot. With respect to claim 8, the Examiner asserts that the word "gramme" has been misspelled. Applicants have amended claim 8 to merely correct this typographical error to recite "gram" in stead of "gramme." For these reasons applicants submit that the objections to the claims are moot and withdrawal of the objections is respectfully requested.

IV. Claim Rejections Under 35 U.S.C. § 112, second paragraph

Claims 1-13 stand rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. According to the Examiner certain phrases found in claim 1 render the metes and bounds of the claim unclear. With respect to M, the Examiner asserts that it is unclear what degrees of ionization are encompassed by the claim.

Further according to the Examiner it is unclear if an n value of 2 only applies to X being the final structure option of a pentavalent phosphorous and/or if such an n value means that the terminal group is X-O-M-R-O-M-R. According to the Examiner it is also unclear which polymers lie within the scope of the claim for polymer (B) because a definition has not been provided for "slightly water-soluble" to separate the polymers that are soluble in water and outside the scope of the claims from those that are only "slightly" soluble and thus encompassed by the claims. The Examiner asserts that "reactive in water" is unclear because does reactive in water mean that the polymers can be reacted with other compounds in water and/or that the polymer reacts with water. According to the Examiner neither "reactive in water" nor "water-sensitive" have been defined. The Examiner also asserts that the term "substantially free" of both rosin and biocidal zinc compounds renders the claims unclear. The Examiner also asserts that it is unclear what is meant by the limitation regarding the metallic copper of the copper-based biocide. According the Examiner is unclear whether less than 2% of copper in the zero oxidation state present in the copper-based biocide is meant.

In response applicants submit claim 1, as amended, more clearly defines the claimed invention. With respect to the metal M in the formula applicants have amended claim 1 to recited that M is Cu, Zn or Te. Accordingly M is no longer defined by degrees of ionization. With respect to n being an integer of 1 to 2 applicants submit that the value of the integer n corresponds to the amount of possible groups attached to X as amended. Where X is for example  the value for n is 1 however in the case that X is the pentavalent phosphorous group the value for n is 1 to 2.

With respect to the scope of the claim for polymer (B) because terms such as "slightly water-soluble", "reactive in water", and "water-sensitive" render the claim allegedly unclear, applicants note that reference to polymer (B), an optional polymer, has been removed from the claims. However, new claims 17 and 18 do recite polymer (B) but also more clearly define the structures for this polymer (B) when it is slightly soluble or water sensitive, the polymer (B) is selected from the group consisting of: polyvinyl methyl ether; polyvinyl ethyl ether; alkyd resins; modified alkyd resins; polyurethanes; saturated polyester resins; and, poly-N-vinyl pyrollidones; and

when the polymer (B) is insoluble in water it is selected from the group consisting of: modified alkyd resins; epoxy polymers; epoxy esters; epoxy urethanes; polyurethanes; linseed oil, castor oil, soy bean oil and derivatives of such oils; vinyl ether polymer; and, polyamine. Applicants submit that these recitations in the claims with respect to polymer (B) more clearly define the claimed invention.

With respect to the term "substantially free" in describing both rosin and biocidal zinc compounds applicants have amended the claims to remove this term and replaced it with "less than 1 wt.%" in order to more clearly define the claimed invention. These amendments are supported by the specification on page 15, lines 21-27 and more clearly define the claimed invention. With respect to the term "metallic" as in "metallic copper" in the claims, applicants submit that the term "metallic copper" would be understood by the skilled artisan to mean free or elemental copper in the context of this invention. For instance, the term "cuprous oxide with a low metal content" (see, page 10, line 7-8 of the application) would make little sense if "metal" encompassed more than the 0 oxidation state. For this reason applicants submit that the claimed invention is described clearly as understood by the skilled artisan and the rejection with respect to the term "metallic" should be withdrawn.

Accordingly, applicants submit that claims 1-13, as amended, clearly describe the anti-fouling composition of the claimed invention. Withdrawal of the rejections of claims 1-13 as being indefinite under 35 U.S.C. § 112, second paragraph is respectfully requested.

Claims 9 and 10 stand rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. According to the Examiner it is unclear what the active step(s) of the claims is/are. In response applicants submit that claim 9 has been amended to recite that the process comprises the step of applying the antifouling coating composition according to claim 1 to the man-made structure to be immersed in a fouling aquatic environment. Therefore, claim 9, as amended, clearly describes the active step of the claimed invention. Claim 10 has been cancelled and the rejection of this claims is therefore now moot. Accordingly, applicants submit that claim 9 clearly describes the process of the claimed invention and its process step. Withdrawal of the rejection of claims 9 and 10 as being indefinite under 35 U.S.C. § 112, second paragraph is respectfully requested.

V. Claim Rejections Under 35 U.S.C. § 103 (a)

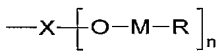
Claims 1-5 and 8-13 stand rejected under 35 U.S.C. § 103 (a) as allegedly being unpatentable over Matsuda et al. (US 5,880,173) as set forth on pages 6-9 of the office action. Claims 1-13 stand rejected under 35 U.S.C. § 103 (a) as allegedly being unpatentable over Matsuda et al as applied to claims 1-5 and 8-13 above, and further in view of Hani et al. (US 5,185,033) as set forth on pages 9 and 10 of the office action.

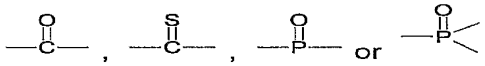
According to the Examiner Matsuda et al discloses a substrate resin metalized with an organic monobasic acid so that the acid pendant group and organic monobasic acid are both bound to the same metal ion. The Examiner asserts that the organic monobasic acid copper acetate is exemplified and will provide a carboxylic acid group with the salt form –COOCuOAc in which n=1, X= -CO-, M is Cu, R is –OR1 and R1 is a methyl monovalent organic residue. The carboxylic acid monomers can be acrylic or methacrylic acids with an acid number of between 25 to 350 mg KOH/g of solid. The antifouling paint composition comprises the metal-containing resin and an antifouling pigment and/or antifouling agent. According to the Examiner Matsuda et al discloses a list of antifouling agents which includes a number of copper containing biocides such as copper oxides and copper dialkyl dithiocarbamates. The Examiner asserts that Matsuda et al does not explicitly prepare a coating composition with both the metalized polymer and a copper-based biocide. According to the Examiner it would have been obvious to the skilled artisan to incorporate a copper-based biocide such as cuprous oxide in the resin composition. Further the Examiner asserts that it would also be obvious to apply this coating to man-made structures such as fish nets and ships that will be immersed in or exposed to a fouling aquatic environment, thereby protecting the structure from fouling.

With respect to the rejection of the claims over Matsuda et al and further in view of Hani et al, the Examiner asserts that Matsuda et al discloses anti-fouling compositions for various man-made structures comprising a metalized polymer A and an antifouling agent such as cuprous oxide but the cited reference does not disclose the copper biocide copper pyrithione. According to the Examiner Hani et al discloses

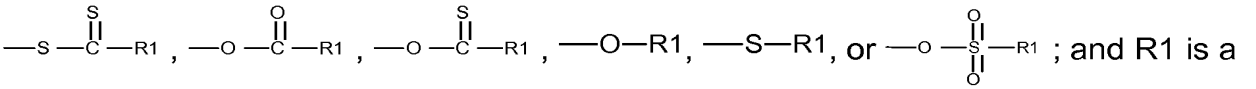
a paint or paint base composition with enhanced biocidal activity with a biocide of copper pyrithione and cuprous oxide. In addition the Examiner asserts that the paint composition in Hani et al can also contain polymers to thicken the composition, such as various celluloses, poly(vinyl pyrrolidone), or poly(ethylene-glycol) which read on the polymer B of the currently claimed invention. According to the Examiner it would have been obvious to the skilled artisan to use a mixture of copper oxide and copper pyrithione as the biocide in the anti-fouling composition of Matsuda et al.

Applicants respectfully submit that these rejections should be withdrawn for at least the following reasons. Applicants submit that contrary to the Examiner's assertions Matsuda et al fails to teach or suggest all of the elements of the claimed invention. Hani et al do not cure the deficiencies in the teachings of Matsuda et al. Thus, even if combined with Hani et al the cited references as applied by the Examiner fail to teach or suggest all the elements of the claimed invention in order for the skilled artisan to arrive at the currently claimed invention of an anti-fouling coating composition comprising 20-100 wt%, calculated on the total amount of film-forming components, of a film-forming polymer (A) having an acid number of from 25 to 350mg KOH/g and having an acrylic backbone bearing at least one terminal group of the formula:



wherein X represents 

M is Cu, Zn or Te; n is an integer of 1 to 2; R represents an organic residue selected from

 and R1 is a monovalent organic residue, and a copper-based biocide for aquatic organisms, said biocide comprising one or more of cuprous oxide, cuprous thiocyanate, cuprous sulphate and copper pyrithione; wherein the copper-based biocide has a metallic copper content below 2% by weight, based on the total weight of the copper-based biocide.

Applicants submit that Matsuda et al. explicitly discloses only the use of cuprous oxide, copper stearate, copper naphthenate and copper dialkylthiocarbamates as antifouling agents its coating compositions. See, Matsuda et al at col. 4, lines 27-44. In this respect Matsuda et al appears to discloses only one of the agents now recited in the claimed invention (cuprous oxide). However, the

Examiner has incorrectly extrapolated that the cuprous oxide of Matsuda et al. – or for that matter Hani et al. - would have 0% by weight elemental copper, based on the weight of the copper. This level of purity is not, for instance, a feature of any commercial source of cuprous oxide known to the Applicants. Moreover, as regards biocidal copper compounds, Matsuda et al. - and for that matter Hani et al. – fail to teach or suggest the importance of reducing the amount of elemental copper impurity to a very low content.

In combination with the specific form of polymer (A), an elemental level of copper of less than 2% in the biocide, as in the currently claimed invention, renders an antifouling composition which combines good, long-term storage-stability in the liquid state (shelf-life) with the ability to perform well in all aqueous environments, irrespective of salinity. See also page 5, 2nd paragraph of the current application. Where the copper based biocide has a metallic copper content of more than 2 wt.%, the object of the present invention is not achieved. See for example page 9, lines 25-27 of the current application.

Matsuda et al provides no guidance to the skilled artisan that the level of elemental copper in a biocidal copper compound has an effect on the coating's properties. Applicants submit that in view of Matsuda et al the skilled artisan would not take the metallic copper content into consideration but would instead decide on the type of copper oxide based on rather different properties. As explained on pages 896 and 897 of the Pigments Handbook chapter on Cuprous oxides under "pigment grades" (enclosed with this response for the Examiner's convenience), the skilled artisan would select the type of cuprous oxide based on particle size. Particle size is the denoted "result effective variable" not metallic copper content when using such cuprous oxides as biocide in an antifouling coating composition.

For this reason the skilled artisan would not, as a matter of standard procedure, choose a low metallic copper content on the basis that he/she would like the cuprous oxide to be as pure as possible. Low metallic copper containing cuprous oxides are not purer than higher metallic copper-containing cuprous oxides: they contain less metallic copper but more of other impurities. The nature of the impurities present in the cuprous oxide depends largely on the manufacturing method. Examples of manufacturing methods are electrolysis, oxidation of metallic copper,

partial oxidation of copper precipitates, grinding of copper scale and chemical techniques (Pigment Handbook, page 896). Some manufacturing routes inherently produce less metallic copper than others, but those routes concomitantly produce higher contents of chlorides, sulphates, acetone-soluble material and / or metals other than copper. Accordingly, the copper-based biocide in the form of cuprous oxide as in the claimed invention is a particular type of cuprous oxide the use of which in an antifouling coating composition as in the claimed invention is not taught or suggest by the cited reference.

The skilled artisan reading Matsuda et al as a whole, applying the teachings therein, and seeking to select a cuprous oxide will select the cuprous oxide based on particle size, not purity. However, even if the skilled artisan would like to select on purity, he/she would first have to decide in what respect this cuprous oxide should be pure: in chlorides, sulphates, metallic copper, other metallic elements or in acetone-soluble material. Selecting a cuprous oxide that is pure in one of these respects will be accompanied by higher impurities in other respects. And, since the skilled artisan considering Matsuda et al has no reason to expect an effect of the metallic copper content on the coating antifouling properties the skilled artisan is not taught nor has a reason to select a cuprous oxide with a low copper content for use in the coating compositions as taught in Matsuda et al. This deficiency in the teachings of Matsuda et al is not cured by the teachings of Hani et al because as described above this reference to does not provide any guidance to the skilled artisan to select a copper-based biocide having a metallic copper content below 2% by weight.

Applicants submit that when the skilled artisan considers Matsuda et al in its entirety without applying any hindsight knowledge from the present application surely he would find it completely surprising, and therefore unobvious, that employing a copper-based biocide having a metallic copper content below 2% by weight in combination with polymer (A) in an antifouling coating composition, would lead to much improved results. Therefore, applicants submit that the skilled artisan would not be motivated to modify the teachings of Matsuda et al either alone or in combination with Hani et al to arrive at the currently claimed invention.

Therefore, for at least the preceding reasons, it is respectfully submitted that the pending claims are not rendered obvious by the cited references. Thus, it is

respectfully requested that the rejections of the claims based on these references should therefore be withdrawn.

VI. Conclusion

It is respectfully submitted that the pending claims are now allowable. All issues raised by the Examiner having been addressed, an early and favorable action on the merits is earnestly solicited.

Respectfully submitted,

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